

BUTTERFLY DIVERSITY, SEASONALITY AND STATUS

ATJUNAGADH, GUJARAT, INDIA

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ABSTRACT

The present investigation focused on the study of butterfly diversity, Seasonality, relative abundance and present status at Junagadh Gujarat, India. The sites of Junagadh city; Bhakta Kavi Narsinh Mehta University campus, Junagadh Agriculture University and Lalbaug were studied throughout the year. These surveys were conducted for twelve months from June, 2017 to May, 2018. The objective of the present survey focussed on the preparation of checklist of butterfly. Furthermore to find out the patterns of butterfly distribution. The extensive survey was made for the taxonomic study and to compare species diversity of butterflies between three sites. During the present study, totally 36 species of butterflies were recorded. A total 36 species of small and large butterflies belonging to five families within an area of Junagadh city Bhakta Kavi Narsinh Mehta University, Agriculture University and Lalbaug were recorded. 8(22%) species from Family Nymphalidae were found, 14(39%) species from family Pieridae were recorded, 9(25%) species from family Lycaenidae were noted, 4(11%) species from family Papilionidae and 1(3%) species from family Hersperidae were recorded. The highest recorded family was Pieridae and lowest species recorded from family Hersperidae. Season wise change was observed in butterfly diversity. The highest number of butterflies seen during the Post monsoon and lowest number were seen during the winter. Highest number of butterfly species recorded during September and lowest were recorded during January and February. During this study, highest numbers of species were recorded from BKNMU 32 species were recorded. While, lowest 23 species were recorded in LB and 25 species were recorded from JAU. This is the first record of butterfly diversity comparison between three sites in the Junagadh city.

KEYWORDS: Butterfly, Junagadh, Diversity & First Record

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INTRODUCTION

Butterflies are regarded as one of the most taxonomically studied group of insects (Robbins and Opler1997). Butterflies are masterpiece of art and beauty of Nature (Rafi *et al.* 2000). They are the source of happiness to everyone due to their marvelous bright attractive colors (Iqbal J., 1978). Butterflies play a vital role as pollinators. Butterflies are considered as ecosystem engineers. Butterflies being one of the most studied groups of insects have been systematically documented since the 18th century (Heppner, 1998). Insect comprise more than half of the earth's diversity of species (May, 1992). Butterflies are scaled wing insects belong to order "Lepidoptera" of class "Insecta" (Pollard, 1991). The butterflies are well known for their beauty as they bear beautiful wings of various colours (Pawarand Deshpandy 2017).

Worldwide, there are more than 28,000 species of butterflies, with about 80% found in tropical regions (Tiplet, 2011). The Indian subcontinent bearing a diverse terrain, climate and vegetation hosts about 1,504 species of butterfly (Tiplet, 2011). Recent data indicate about 1318 species in India, according to Varshney and Smetacek

(2015).

Healthy biological communities depend on insects as pollinators, seed dispersers, herbivores, predators and prey (Battist, 1988). Within the ecological communities, insects comprise a large proportion of the biomass and are serious conduits of energy through the system (Battist, 1988). The term Butterfly is often thought of as the two natural groups that make up the order “Lepidoptera” but in reality the butterflies are only one of many Lepidoptera lineages (Lafontaine and Troubridge, 1998). Butterflies are more closely related to the larger moths than either group is to the more primitive families of moths (Lafontaine and Troubridge, 1998). The butterflies and the larger moth are often associated in a group called the “Macro Lepidoptera” (Lafontaine and Troubridge, 1998). The families of smaller moths are referred to as “Micro Lepidoptera” (Lafontaine and Troubridge, 1998).

Family of Butterfly

Butterflies with moths are considered under the same group “Lepidoptera”, they fluctuate in their niche and habitats. Most butterflies being diurnal choose the warmth of the sun for basking and feeding, whereas majority of moths are exemptions to this rule. Presently, butterflies are classified into two super families, of which Hesperioidea includes the skippers, while Papilionoidea includes the rest, “the true” butterflies. Hesperioidea consist of a single family Hesperidae (Skippers), whereas Papilionoidea has four families; Papilionidae (Swallow tails), Pieridae (whites and yellows), Nymphalidae (Brush-footed butterfly) and Lycaenidae (Blues) (Parasharya and Jani, 2007)

Ecological Importance of Butterflies

Butterflies occupy a vital position in ecosystems and their occurrence and diversity are reflected as good indicators of the health of terrestrial biota (Kunte, 2000). Butterflies are one of the best insect studied group and highly sensitive to habitat disturbance. They are commonly used as an indicator of environmental quality (Varshney 1993; Kremen 1994; Kocher and Williams 2000; Koh and Sodhi 2004). Butterflies enable substance of ecosystem services through their role in pollination and serving as an important food chain component (Chakravarty et al, 1997). Butterfly being a potential pollinating agent of their nectar plants as well as an indicator of the health and quality of their plants and the ecosystem as a whole (Nair et al. 2014). Exploration of butterfly thus becomes important in identifying and preserving potential habitat under threat (Nair et al. 2014). Other than their aesthetic value, butterflies have important roles in the functioning of forest ecosystems. Because of their diversity, wide distribution, specific to vegetation type, rapid Response to perturbation, urbanization, taxonomic tractability, statistically significant abundance and ease of sampling, they have been considered useful organisms to monitor environmental changes (Raghavendra et al. 2011)

Extinction of Butterfly Species

Insects are the dominate and earth's most varied organisms, accounting for half of describing species of living things and three quarters of all identified animals and it is estimated that more species of insects that known at present remain to be discovered among insects (Wijesekara and Wijesinghe 2003). Butterflies are sensitive to climate change, such as pollination and habitat loss, and cause them to be more responsive. Therefore, an abundance of butterflies usually indicates a healthier ecosystem (Iqbal et al. 2016). The present study focused on butterfly diversity, relative abundance and status at Junagadh city; Bhakta Kavi Narsinh Mehta University campus, Lalbaug and Junagadh Agriculture University, Gujarat, India.

MATERIALS AND METHOD

Study Area



(Source of Image: <https://www.veethi.com/places/gujarat-junagadh-district-287.htm>)

Figure 1: Map of Study Area – Junagadh

Junagadh city is the headquarters of Junagadh district in the Indian state of Gujarat (Figure: 1). Gujarat provides a diverse range of habitats (Raval, 2011). The city is the seventh largest city in Gujarat, located at the foot of the Mountain Girnar. Junagadh 350 km south west of state capital Gandhinagar. Junagadh has a tropical wet and dry climate, with three distinct seasons observed. Junagadh faces adverse climatic condition in the summer months, the highest temperature 44.6 °C (Chopada, et al. 2018). In the present study seasons and the distribution of the months was considered as winter (December to February), summer (March to May), monsoon (June to August) and post monsoon (September to November). The Arabian Sea and the Gulf of Cambay are also influential factors affecting the climate and weather of Junagadh. The city receive rain by the south west monsoon from June to September. In 2017 it records a rain fall of 804.4mm seasonally and 806.9 annually (Chopada, et al. 2018).

Study Site

Site A: Bhakta Kavi Narsinh Mehta University, Junagadh. (BKNMU)(Figure 2)

Site B: Junagadh Agriculture University. (JAU)(Figure 3)

Site C: LalBaug. (LB)(Figure 4)

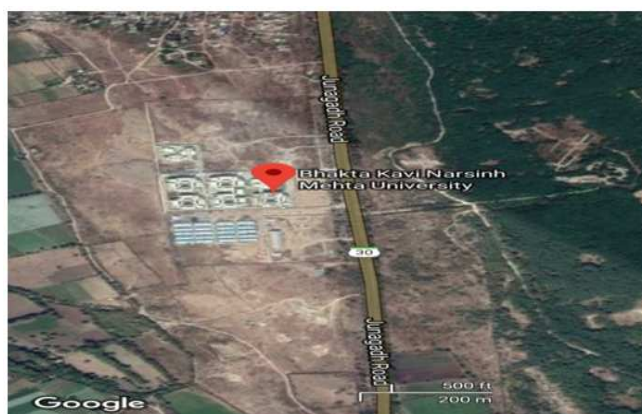


Figure 2: SITE A-Bhakta Kavi Narsinh Mehta University, Junagadh (21°43'83" N and 70°45'79"E)



**Figure 3: SITE B-Junagadh Agriculture University
((21°50'3" N and 70°45'02"E)**



Figure 4: SITE C-LalBaug (21°51'54" N and 70°45'64"E)

MATERIALS AND METHOD

Hand swiping net, cyanide bottle, insect pins, a wooden board, naphthalene balls, wooden collection boxes, and camera, pencil and field notebook (Iqbal et al 2016).

These surveys were conducted for 12 months from June 2017 to May 2018. Butterflies were observed under particular time at 8 a.m. to 6 p.m. (Nair et al.2014) Selected sites visited about 72 times. Butterflies were observed under some visits by random sampling technique. Sweep net method and visual observations were utilized to document the Butterflies. Transect method was utilized to document the Butterflies(Gandhi and Dolly Kumar, 2015).

Observations were mixed with fixed transects of 40m long and 2.5m wide in the three selected sites. Transects were surveyed using a transect count method, popularly known as "Pollard walk" (Pollard et al. 1975; Waipole and Sheidom, 1999). All the butterflies were recorded with time and number of individuals seen for butterflies. Often as possible to obtain sufficient photographs to enable positive identification of species. Photographs were taken with a digital camera. Butterflies were primarily identified directly in the field with the help of field guides followed by photography, and rarely by capture (Evans WH, 1932, Kunte 2000, kehimker, 2008, Wynter-Blyth 1957 The butterfly were identified using standard field guides and references (Prasharya andJani. 2007, kehimker 2008, kunte 2000, wynter &Blyth 1957). If required the collected specimens were exterminated in a cyanide bottle and subsequently were placed on a wooden board

for setting wings with insect pins through the thoracic region. As the specimens dried, they were arranged in wooden collection boxes. Naphthalene balls mounted on pins were kept in collection boxes for the protection of the specimens from different pests (Iqbalet al. 2016).

All scientific names followed in the present study are in accordance with Parasharya&Jani, 2007 and G.S. Arora et al 2009. The seasonality was determined using presence-absence scoring method and there after % of occurrence was calculated to determine the status. The observed butterflies were categorized in five categories based on their abundance in selected sites: The observed butterflies were categorized in five categories based on their abundance: VC-very common (> 100 sightings), C-common (50-100 sightings), NR-not rare (15-50 sightings), R-rare (2-15 sightings), VR-very rare (1-2 sightings) (Tiplet, 2006). Table: 1

RESULT AND DISCUSIONS

The butterfly fauna of Junagadh city is rich. During the present study, totally 36 species of butterflies were recorded. A total of 36 species of small and large butterflies belonging to five families within an area of Junagadh city Bhakta Kavi Narsinh Mehta, University, Junagadh Agriculture University and Lalbaugwere recorded 0.8 (22%) species from the family of Nymphalidae were recorded, 14 (39%) species from the family of Pieridae were noted, 9 (25%) species from the family of Lycaenidae were documented, 4 (11%) species from the family of Papillionidae were recorded and 1 (3%) species from the family of Hersperidae were recorded. The highest recorded family was Pieridae and lowest was Hersperidae. Season wise change was observed in butterfly diversity. The highest number of butterflies seen during the Post-monsoon and lowest number seen during the winter. In monthly highest number of butterfly species recorded during September followed by August and lowest number of species recorded during January and February followed by December. (Table: 1, Figure: 5).

During this study, highest numbers of species were recorded from BKNMU, 32 species were recorded. While, lowest numbers of species were recorded from LB 23 species were recorded. On the other hand, 25 species were recorded at JAU.

Family Nymphalidae represent 8(22%) species, Tawny Coster (*Acraeaterpsicore* (Linnaeus, 1758)), Plain Tiger *Danauschrysippuschrysippus* Linnaeus, 1758, Great Eggfly (*Hypolimnasbolinajacintha* Drury, 1773), Lemon Pansy (*Junonialemoniaslemonias* Linnaeus, 1758), Blue Pansy (*Junoniaorithyaocyale* Hubner, 1816), Peacock Pansy (*Junoniaaalmanna*Linnaeus1758), Joker (*Bybliailithyia* Drury, 1773) and Common Evening Brown (*Melanitisledaleda* Linnaeus, 1758).

FamilyPieridae represent14(39%) species, Mottled Emigrant(*Catopsiliapyranthepyranthe* Linnaeus, 1758), Orange Emigrant (*Catopsiliascylla* Linnaeus, 1763), Lemon Emigrant, (*Catopsiliapomonapomona* Fabricius, 1775), Common Grass Yellow (*Euremahecabehcabecabe* Linnaeus, 1758), Small Grass Yellow (*Euremabrigitta* Stoll, 1780), Spotless Grass Yellow(*Euremalaetalaeta* Boisduval, 1836), Crimus-tip (*Colotisdanaedanae* Fabricius, 1775), Indian Pioneer (*Belenoisaurotaaurota* Fabricius, 1793), Yellow Oranre-tip (*Ixias pyrenekausala* Moore, 1877), White orange tip (*Ixias marianne* Cramer, 1779), Little Orange-tip (*Colotisetridaetrida* Boisduval, 1836), Indean Cabbage White (*Pieriscanidiacanis* Evans, 1912) and Large Cabbage White (*Pierisbrassicaenepalensis* Gray, 1846) and Small Salmon Arban(*Colotisamataamata* Fabricius, 1775).

Family Lycaenidae represent 9(25%) species, Zebra Blue (*Leptotesplinius* Fabricius, 1793), Striped Pierrot(*Tarucusnara* Kollar 1848), Tailless Lineblue (*Prosotasdubiosaindica* Evans, 1925), Plains Cupid (*Chiladespandavapandava* Horsfield, 1829), Forget-me-not (*Catochrysopsstrabostrabo* Fabricius, 1793), Lime Blue(*Chiladeslajuslajus* Stoll, 1780), Gram Blue(*Euchrysopsceus*Fabricius, 1798), Tiny Grass Blue(*Zizulahlaxhylax*Fabricius), 1775 and Lesser Grass Blue (*Zizinaotis*Fabricius, 1787)

Family Papilionidae represent 4(11%) species, Tailed Jay (*Graphiumagamemnonagamemnon* Linnaeus, 1758), Lime Swallowtail(*Papiliodemoleusdemoleus* Linnaeus, 1758), Common Rose (*Pachlioptaaristolochiae* Fabricius, 1775) and Common Mormon (*Papiliopolytes* Linnaeus, 1758). Family Hersperiidae represent 1(3%) species, Indian Grizzled Skipper (*Spialialgalbagalba* (Fabricius, 1793)

Analysis of these species for relative abundance revealed that 7(19%) species Very common,5(14%) Common, 14(39%) Not rare, 6(17%) Rare and 4(11%) Very rare. Family Nymphalidae represent, 2 Very common, 2Not rare, 3 Rare and 1 Very rare. Family Pieridae represent, 5 Very common, 4 Common and 5Not rare. Family Lycaenidae represent, 1 Common, 3 Not rare, 3 Rare and 2 Very rare. Family Papilionidae represent, 4Not rare. FamilyHersperiidae represent 1Very rare. Table: 2 and Table:3 (Figure).

One species Gram blue- *Euchrysopsceusfabricius*, 1798belong to ScheduleII under Wild Life Protection Act, 1972.

If we compare our results with a few previous researches we found that, Schedule IIalso reported by Kunte (2000), he concluded that revision of the schedule list is essential to provide appropriate and adequate legal protection to Indian butterflies. Nair et al.(2014) studied a total of 49 species of butterflies under five families and 36 genera, nymphalidae was recorded as the most dominant family in terms of number of species family, represented by 20 species followed by Lycaenidae (12), Pieridae (10), papilionidae (6) and Hersperiidae (1). Out of these 49 species, five species come under the Indian Wildlife Protection Act 1972. Deshpande(2016)studied butterfly diversity of Satara Tehsil, district Satara Maharashtra. They had studiedonly family Nymphalidae. They studied 55 individuals of family Nymphalidae, belonging to 9 sub families and 28 genera identified and recorded.

Suryanarayana et al. 2016 work was on the biodiversity of Butterflies in in Seshachalam Bio-reserve forest. Field exploration was employed periodically. Nearly 106 butterfly species were recorded from five families in environs of Seshachalam bio reserve forest area. The number of population recorded from the family Nymphalidae (31%) with highest followed by Lycaenidae (21%), Pieridae(15%), Hersperidae (15%) and least number of population was recorded from Papilionidae (13%). Doherty was the first taxonomist who studied the butterfly in 1886. He had studied the fauna of Kashmir.

In 2018 Nimbalkar RK and Avhad MB, Species Diversity and Distribution of Butterflies from Daulatabad Fort area of Aurangabad District.35 species of butterflies belonging to 12 genera from 3 families and 4 subfamilies was recorded from the study area. During present investigation, it was found that 2 (Leptosianina and Graphiumdoson) species were rare, while describing their status and justifies its inclusion in Scheduled List suggesting the need for its strict conservation measures.

CONCLUSIONS

The butterfly diversity of Junagadh city is comparatively rich. There was a difference in butterfly population, according to the site, vegetation and season. Total 1801 individuals were observed. Selected sites were visited 72 times. Seasonal variation in the diversity was observed. Season wise deviations were observed in butterfly populations. The highest number of butterflies seen during the Post-monsoon and lowest number seen during the winter. *Euremabrigitta* (Stoll, 1780) was found in highest number. These four species were found throughout the year: *Euremahebecabe* (Linnaeus, 1758), *Euremabrigitta* (Stoll, 1780), *Acraeaterpsicore* (Linnaeus, 1758), *Danauschrysippuschrysippus* (Linnaeus, 1758)

Table 1: Seasonally and Monthly Distribution of Butterfly Individuals

Sr. No	Common name	2017							2018					Total
		Monsoon			Post monsoon			Winter			Summer			
		J	J	A	S	O	N	D	J	F	M	A	M	
1	Tawny Coster	2	10	50	65	55	2	1	2	2	2	2	2	195
2	Plain Tiger	2	7	30	30	20	1	1	5	5	5	7	3	116
3	Great Eggfly				3	5								8
4	Lemon Pansy			9										9
5	Blue Pansy				19									19
6	Peacock Pansy		1											1
7	Joker						1	8						9
8	Common Evening Brown				17							13	13	43
9	MottledEmigrant	10	20	40	40	30					3			143
10	Orange Emigrant	3	10	10	3							3	3	32
11	Lemon Emigrant	20	15	20	20	20						2	6	103
12	Common GrassYellow	10	10	10	30	40	40	4	5	5	5	5	7	171
13	Small Grass Yellow	20	30	35	40	40	16	2	7	7	8	7	7	219
14	Spotless Grass Yellow			10	15	15	15	6	3	3	2	2		71
15	Crimus-Tip	8	8	6	6	6	6							40
16	Indian Pioneer			11	13									24
17	Yellow Orange-Tip	25	25	30	30									110
18	White Orange-Tip	9	3	25	25								10	72
19	Little Orange-Tip				20									20
20	Indean Cabbage White	7	12	10	13								16	58
21	Large Cabbage White	15		15	15								15	60
22	Small Salmon Arban		20											20
23	Zebra Blue				3	1								4
24	Striped Pierrot				2	1								3
25	Tailless Lineblue											1		1
26	Plains Cupid	7	25	25	20									77
27	Forget-Me-Not				7									7
28	Lime Blue				1									1
29	Gram Blue	1	1	10	11									23
30	Tiny Grass Blue			8	10									18
31	Lesser Grass Blue			4	19									23
32	Tailed Jay	1	1		4	6	1	1			1	1		16
33	Lime Swallowtail	3	3	9	7	5	1	1			2	2	3	36
34	Common Rose				17									17
35	Common Mormon				10	18					1	1		30
36	Indian Grizzled Skipper				1	1								2
	Total	143	201	367	516	263	83	24	22	22	29	46	85	1801

Table 2: List of Butterflies Recorded From All the Sites Together With Family, Common Name, Scientific Name, Wing Spawn, Comparison of Sites and Status

No	Family	Common Name	Scientific Name	Wing Spawn	BKNMU (Site A)	JAU (Site B)	Site C	Status
1	Nymphalidae	Tawny Coster	<i>Acraeaterpsicore</i> Linnaeus, 1758	60 mm	+	+	+	VC
2	Nymphalidae	Plain Tiger	<i>Danauschrysippuschrysippus</i> Linnaeus, 1758	80 mm	+	+	+	VC
3	Nymphalidae	Great Eggfly	<i>Hypolimnasbolinajacintha</i> Drury, 1773	70 mm	+			R
4	Nymphalidae	Lemon Pansy	<i>Junonialemoniaslemonias</i> Linnaeus, 1758	45 mm	+	+	+	R
5	Nymphalidae	Blue Pansy	<i>Junoniaorithyaocyale</i> Hubner, 1816	60 mm	+			NR
6	Nymphalidae	Peacock Pansy	<i>Junoniaalmana</i> Linnaeus, 1758	60 mm	+			VR
7	Nymphalidae	Joker	<i>Bybliailithyia</i> Drury, 1773	45 mm	+	+		R
8	Nymphalidae	Common Evening Brown	<i>Melanitisledaleda</i> Linnaeus, 1758	60 mm	+	+		NR
9	Pieridae	Mottled Emigrant	<i>Catopsiliapyranthepyrante</i> Linnaeus, 1758	50 mm	+	+	+	VC
10	Pieridae	Orange Emigrant	<i>Catopsiliascylla</i> Linnaeus, 1763	60 mm	+	+		NR
11	Pieridae	Lemon Emigrant	<i>Catopsiliapomonapomona</i> Fabricius, 1775	65 mm	+	+	+	VC
12	Pieridae	Common Grass Yellow	<i>Euremahecabecabecabe</i> Linnaeus, 1758	50 mm	+	+	+	VC
13	Pieridae	Small Grass Yellow	<i>Euremabrigitta</i> Stoll, 1780	30 mm	+	+	+	VC
14	Pieridae	Spotless Grass Yellow	<i>Euremalaetalaeta</i> Boisduval, 1836	40 mm	+	+	+	C
15	Pieridae	Crimus-tip	<i>Colotisdanaedanae</i> Fabricius, 1775	55 mm	+	+		NR
16	Pieridae	Indian Pioneer	<i>Belenoisaurorataurota</i> Fabricius, 1793	60 mm			+	NR
17	Pieridae	Yellow Orange-Tip	<i>Ixias pyrenekausala</i> Moore, 1877	60 mm	+	+	+	VC
18	Pieridae	White Orange-tip	<i>Ixias marianne</i> Cramer, 1779	55 mm	+	+	+	C
19	Pieridae	Little Orange-tip	<i>Colotisetradaetrida</i> Boisduval, 1836	40 mm	+	+		NR
20	Pieridae	Indean cabbage white	<i>Pieriscandiacanis</i> Evans, 1912	45 mm	+	+	+	C
21	Pieridae	Large Cabbage White	<i>Pierisbrassicaenepalensis</i> Gray, 1846	58 mm	+	+	+	C
22	Pieridae	Small Salmon Arban	<i>Colotisamataamata</i> Fabricius, 1775	50 mm	+			NR
23	Lycaenidae	Zebra Blue	<i>Leptotesplinius</i> Fabricius, 1793	30 mm	+	+	+	R
24	Lycaenidae	Striped Pierrot	<i>Tarucusnara</i> Kollar 1848	24 mm	+	+	+	R
25	Lycaenidae	Tailless Lineblue	<i>Prosotasdubiosaindica</i> Evans, 1925	10 mm			+	VR
26	Lycaenidae	Plains Cupid	<i>Chiladespandavapandava</i> Horsfield, 1829	35 mm	+	+	+	C
27	Lycaenidae	Forget-me-	<i>Catochrysopsstrabostrabo</i> Fabricius, 1793	25 mm	+	+		R

		not						
28	Lycaenidae	Lime Blue	<i>Chiladeslajuslajus</i> Stoll , 1780	10 mm	+			VR
29	Lycaenidae	Gram Blue	<i>Euchrysops scenjusa</i> Fabricius, 1798)	20 mm	+		+	NR
30	Lycaenidae	Tiny Grass Blue	<i>Zizulahlaxhylax</i> Fabricius , 1775	20 mm	+		+	NR
31	Lycaenidae	Lesser Grass Blue	<i>Zizinaotis</i> Fabricius, 1787	22 mm	+		+	NR
32	Papilionidae	Tailed Jay	<i>Graphiumagamemnonagamemnon</i> Linnaeus, 1758	85 mm	+	+		NR
33	Papilionidae	Lime Swallowtail	<i>Papiliodemoleusdemoleus</i> Linnaeus, 1758	90 mm	+	+	+	NR
34	Papilionidae	Common Rose	<i>Pachlioptaaristolochiae</i> Fabricius, 1775	80 mm		+	+	NR
35	Papilionidae	Common Mormon	<i>Papiliopolytes</i> Linnaeus, 1758	90 mm		+	+	NR
36	Hesperiidae	Indian Grizzled Skipper	<i>Spialagalbalgalba</i> Fabricius, 1793	24 mm	+			VR

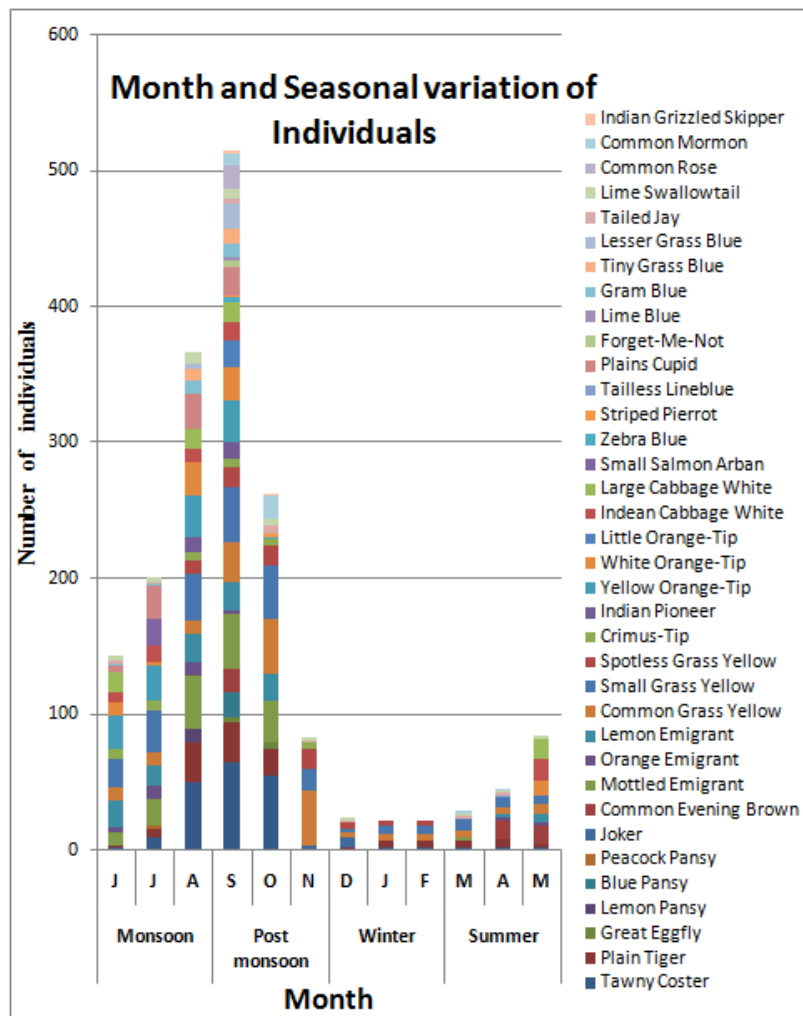


Figure 5: Month and Seasonal Variation of Individuals

Table 3: Distribution of Family and Species

Sr. No.	Family	Species	% of Species	Status				
				VC	C	NR	R	VR
1.	Nymphalidae	8	22%	2		2	3	1
2.	Pieridae	14	39%	5	4	5	-	-
3.	Lycaenidae	9	25%	-	1	3	3	2
4.	Papilionidae	4	11%	-	-	4	-	-
5.	Hesperiidae	1	3%	-	-	-	-	1

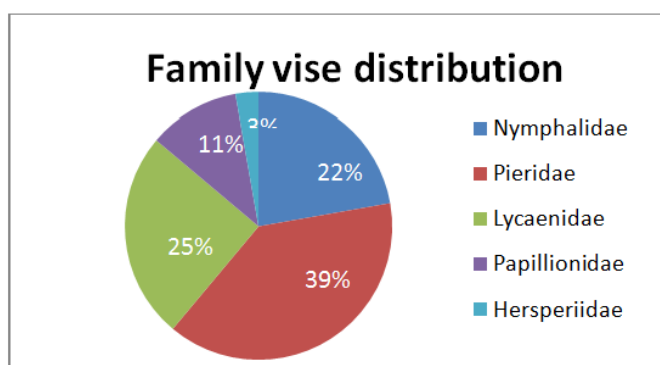


Figure 6: Family Vise Distribution of Junagadh City Area

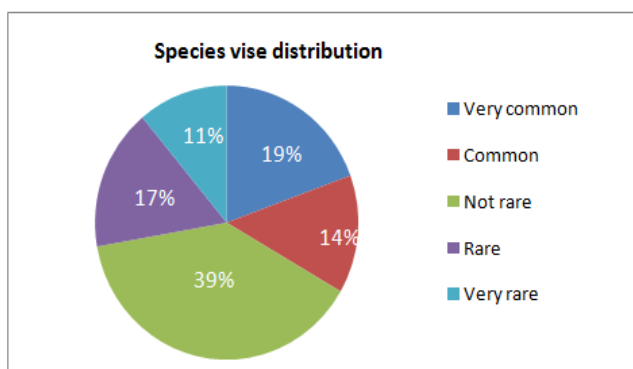


Figure 7: Species Wise Distribution of Junagadh City Area

Family: Papilionidae

Figure 8

Family: Hersperiidae



Figure 9

Family: Pieridae



Figure 10

Family: Hersperiidae





Figure 11

Family: Nymphalidae

Figure 12

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Conflicts of Interest: None declared.

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